vey in the preparation of this manuscript.—L. BARRIE HUNT, *Dept. of Zoology, Eastern Illinois Univ., Charleston 61920. Accepted 31 July 1977.*

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**A volumetric analysis of Sharp-tailed Grouse sperm in relation to dancing ground size and organization.**—Although the lek, or dancing ground display and mating behavior of *Pedioecetes phasianellus* has been described by several authors (reviewed in Hjorth, Viltrevy 7:184–596, 1970), histological and physiological correlates of lek behavior have received less attention (Trobec and Oring, Am. Midl. Nat. 87:531–536, 1972). Since most matings are known to occur near the center of the dancing ground (Hjorth op. cit.), the present study was designed to investigate the hypothesis that levels of testicular sperm are greater in males located centrally compared with males located at the periphery of dancing grounds. The additional possibility that levels of sperm are lower for males on smaller grounds (<10 males) was also examined.

Sixty-four males were collected from grounds of known size in central Manitoba. Whenever possible, 4 males were collected each week, 2 from a large and 2 from a small dancing ground, during 2 successive breeding seasons. For small grounds, a random sampling technique was used to determine which male was to be collected. For large grounds (10 or more males present), 1 male whose territory was near the center, and 1 from the periphery, were collected each week. Within 10 min of collection, a gonad was removed, the volume measured by water displacement in a graduated cylinder, and tissue samples fixed in Bouin's solution. Subsequent sections 7 $\mu$ thick were stained by Masson's trichome technique (Culling, Handbook of Histopathological Techniques, 1963, Butterworths, London). For quantitative assessment of sperm, the method of Chalkley (J. Cancer Inst. 4:47–53, 1943) was used. Structures lying under the tips of 4 pointers located in the eyepiece of a microscope were recorded as "hits." The procedure was repeated by moving the stage a short distance along a zigzag course through the section, for a total of 175 times per testis. The relative frequency of "hits" on any particular cell type, including sperm, was taken as the relative volume occupied by cells of that type. For statistical comparison between the different groups of males sampled, we used a sign test ($\chi^2$) based on comparisons between pairs of birds collected during the same week from different positions within large dancing grounds (central versus peripheral) or between large and small dancing grounds (small versus central, and small versus peripheral).

All birds collected during the breeding season appeared to be physiologically capable of breeding. No differences ($P > .05$) were present in overall testis volume among the three groups of males. Differences were, however, present in the relative volume of sperm present in the testes (Fig. 1). For both years combined, males located centrally on large dancing grounds possessed a significantly greater mean level of sperm than did the peripheral birds on the same grounds ($P < .001$; $\chi^2 = 16.0$). The volume of sperm for males from small grounds was also significantly greater than that of peripheral males from large grounds ($P < .01$; $\chi^2 = 9.0$). Differences between males from small grounds and central birds from large grounds, although present in both years (Fig. 1) were not significant ($P > .05$; $\chi^2 = 1.2$).

Although the relationships between central and peripheral birds from large dancing grounds and birds from small grounds tended to be similar for both years in which collections were made, levels of spermatozoa reached peak levels appreciably later in the

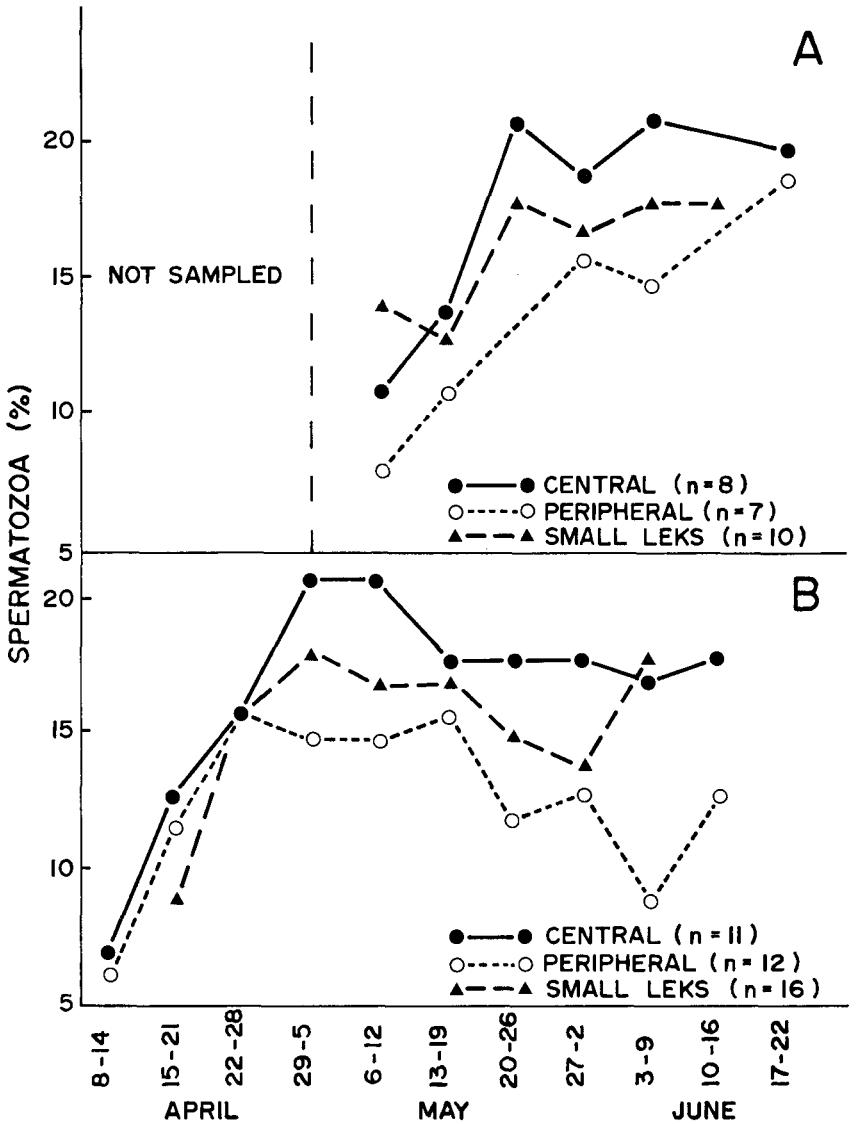


FIG. 1. Volume of spermatozoa in testes of central and peripheral males from large dancing grounds, and males from small grounds, at successive weekly intervals during the (A) 1967 and (B) 1968 breeding seasons. (Numbers in parentheses indicate total sample size.)

season in 1967 than in 1968 (compare Fig. 1, parts A and B). Peak attendance of females at the lek was also later, by up to 3 weeks in 1967. The spring of 1967 was colder and more extended than in 1968, as indicated by the mean monthly temperature for April, which was 3.7°C lower in 1967. These results raise the possibility that spring temperatures may act as modifiers to influence the gonadal cycle in this species (cf Farner, Breeding Biology of Birds, Natl. Acad. Sci., Washington, D.C., 1973).

The hypothesis that the testes of central males on large dancing grounds achieve higher volumes of sperm than do those of males located at the periphery was supported by the data. Whether there is a causal relationship between sperm volume, position on the dancing ground, and proportion of total matings done by a particular male awaits further study. Considered functionally, however, the results raise the definite possibility that the central birds are best suited, biologically, to perform the majority of matings on large grounds. The further possibility that males from large dancing grounds have larger sperm volumes than those from smaller grounds was not supported, in that males from small grounds had significantly larger sperm volumes than peripheral males from large grounds, and did not differ significantly from central males on large grounds. The latter result suggests that males on small dancing grounds should be no less able to fertilize receptive females than are males from central locations on large grounds. The possibility remains that differences in social stimulation may act in other ways to reduce the reproductive success of small leks. Further studies are clearly required to assess this and other possible behavioral and histological correlates of dancing ground size and organization.

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